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Going for groundwater: development pathways of family farms in a large-scale irrigation scheme in Morocco

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Large-scale irrigation schemes have traditionally been a privileged option to address food security in semi-arid regions (Framji et al, 1984), but also to create a relatively well-off stable agricultural class in order to secure the rural areas. Gilmartin (2006) defined the modern, capitalist state of the 19th century as "*an alliance of science, the maximizing producer, and the state, in the subjugation of the earth*". The contrast between such 'maximizing producers' and existing subsistence farms could not be greater. Encouraging the establishment of small prosperous farmers was an obsession of irrigation authorities to reap the benefits of state investments (Préfol, 1984; Gilmartin, 1994). Farmers with too much land would be absentee farmers, not tending their farms. Too small farms would not be viable. A centrally planned rural development structure accompanied farmers in transforming their farm holdings. In Morocco, the administration furnished farm services and imposed cropping patterns, favoring industrial crops such as cotton or sugar beet. In practice, farmers have always found ways to circumvent the rigid regulation system (Lees, 1984). Farms were *de facto* divided between heirs, land was rented in by landless farmers, and farmers "diverted" water allocated to industrial crops to other crops. Off-farm activities were a source of revenues, downsizing the importance of irrigated agriculture. Arguably, the biggest change occurred from the 1980s onwards by the access that farmers acquired to groundwater through private wells. By obtaining a certain hydraulic independence, farmers no longer relied on "*the implacable order of an extraordinary authority …at the origin of the distribution of life*" (Pascon, 1978), and could opt for alternative development options. The aim of the paper is to analyze development pathways of family farms in a large-scale irrigation scheme in relation to the changes that have occurred over the past 20 years in the access to groundwater, informal land markets, and external revenues. We adopted the framework of Meert et al. (2005) which combines Polyani's concept of economic integration (market exchange, and redistribution and reciprocity mechanisms) applied to family farms, with different forms of farm diversification determining the development paths of farms.

The study was carried out in the 100,000 ha Tadla irrigation scheme in Morocco. We interviewed 295 farmers, who were selected using a stratified random sampling method. The questionnaire related to the farm structure, farming systems, water access, and farm and external revenues. Next we conducted semi-structured interviews with selected farms in order to understand the development pathways of these farms. We used SPSS software to build a farm typology on the basis of access to groundwater. The same software was also used to analyze the functioning of the different farm types in order to explore the farm strategies.

Our survey showed a large diversity of farm types in Tadla. On *micro-farms* (21%) without access to groundwater, farmers practise low-risk agriculture (cereals, fodder, sugar beet, olives). Almost 80% of the farms have another source of revenue when migration revenues are included. Farmers work as agricultural labourers or provide agricultural services (160 days/year), doubling the farm revenues. *Small mixed farms* (32%) without access to groundwater have similar cropping patterns, but focus on dual-purpose cattle rearing (milk,

meat). They possess on average 5 cows and obtain the highest milk productivity per ha. 28% of the farms access groundwater through informal arrangements, obtaining higher yields for cereals and alfalfa. 79% of the farms have off-farm activities. The access to groundwater on *small horticultural farms* (11%) favours the development of diversification crops. Horticulture represents 13% of the irrigated area. These farms obtain mediocre yields in cereals and fodder and have little revenues from cattle rearing. They focus on obtaining solid revenues from horticulture by investing in irrigation equipment (over 1000 €/ha on average). *Medium sized cattle farms* (31%) with access to groundwater grow mostly traditional crops (cereals, fodder, sugar beet) with a high percentage of alfalfa for milk production. These farms show the highest irrigation water use per ha. Animal revenues represent 40% of farm revenues. An "associate" is responsible for farming activities in almost a third of the farms. *Large farms* (5%) with access to groundwater are generally cultivated by a single farmer (20-80 ha). There are two main orientations: i) citrus specialization where citrus represents 50% of the area, and ii) milk and cattle orientation with herds of 30 heads on average. The average area of cereals amounts to 10 ha with, in some cases, seed reproduction.

Only about 36% of the farms, having more than 5 ha of land and access to groundwater, generate sufficient revenues to cover the expenses of an average rural household, according to figures of the High Commission for Planning. Agricultural revenues are correlated to farm sizes with significantly higher revenues in large farms but average revenues per ha were found to be the same.

We identified three development options for family farms: informal access to land, securing an access to groundwater, and obtaining external revenues. In Tadla, the distribution of the land is highly inequitable. Farms of less than 5 ha represent only 31% of the irrigated area but 82% of the number of farms. 47% of the farms own less than 2 ha. In addition, 40% of the registered farms are now cultivated by more than 2 farmers, usually heirs. All farm types but the large ones face this land division. The available area per farmer then drops to less than 2 ha, but farmers may also access other plots through renting or share-cropping agreements. Indirect cropping –mostly renting and sharecropping- represents 30% of the farms in the case of medium sized farms with possibilities to rent more than 10 ha. Indirect cropping represents almost a third of the cultivated area in the Tadla. The dynamic land markets of the Tadla thus compensate for the lack of land. However, these markets mainly concern the middle-size farms, as capital is required to rent the land and invest in agricultural activities.

Since the early 1980s, the annual surface water allocation in Tadla was reduced by 35% due to repetitive droughts. In certain years, the reduction went up to 70%, extending the water turn from a weekly to a monthly basis and restricting the crop choice. This prompted farmers to turn to groundwater through private wells. In the 1990s farmers installed tubewells or transformed existing wells in order to maintain access to a decreasing groundwater table. Presently, more than 8,300 tubewells and wells serve 46% of the farmers (but on 70% of the surface area), while 13% obtain access through informal arrangements with neighbors or family members. It is mainly the micro-farms and the small mixed-farms that do not have access to groundwater. They do not have the means to install a tubewell or consider that the investment is not justified. The access to groundwater does not significantly modify the cropping intensities, but it conditions the crop choice. Groundwater provides the

opportunity to diversify cropping patterns (citrus fruits, horticulture, maize) and also allowed more recently an intensification and improvement of productivity with the installation of drip irrigation. Farms with access to groundwater also increased the irrigation volumes of alfalfa, cereals and sugar beet. They obtained higher yields for cereals (5 T/ha versus 3.5 for those without access to groundwater). Medium size milk farms improved fodder production and were able to have more cattle.

The Tadla is a recent area of outward migration to Italy and Spain (Khachani, 2005; de Haas, 2007). More than half of the farms have at least 1 family member abroad. Our results show that migration revenues are not invested systematically in agriculture, but contribute first to an improvement of lifestyles (household equipment, housing). This is in agreement with earlier studies in the area, which showed that about 80% of these revenues were invested in housing (Khachani, 2005). As regards agriculture, our results show that 47% of the farmers with regular migration revenues installed a tubewell versus 36% when they did not have such revenues. In addition, farmers paid some of the current expenditure with these revenues, such as the bi-annual bills for surface water and labor expenses for on-farm activities. According to a recent study, the migration revenues are currently declining (less than 20,000 dirhams/year), as family members have difficulty to find contracts in (especially) Spain (Chohin-Kuper, 2009). Farmers reconsider the opportunity cost of sending family members abroad. This will not only have an impact on family revenues, and indirectly on agricultural investments and expenditures, but is likely to have a profound impact on the professional perspectives of youngsters in the Tadla area, and thus on the development pathways of the farms. In addition to migration revenues, our results show that 40% of the farms have substantial off-farm revenues, related to activities such as trading, agricultural services or agricultural labor. Farmers are reluctant to invest off-farm revenues in agricultural development. However, without such revenues, farms would not be able to sustain the droughts and other risks linked to farming. In 2005, a dry year, 50% of the farms had negative economic results.

The first conclusion of the paper is that the location of farms in a large-scale state-controlled irrigation scheme has reinforced their economic integration through redistribution mechanisms (access to relatively cheap surface water, access to infrastructure such as roads, access to subsidies, possibility to rent out land at high rates). These mechanisms seem to be particularly in favor of large farm holdings, which use more (subsidized) water and obtain most of the subsidies, for example to convert to drip irrigation (Bekkar et al, 2007). These farms appear from the outside highly integrated through market mechanisms, but all benefit from redistribution mechanisms. Some of the smaller farms also manage to take advantage from these mechanisms by obtaining subsidies for planting citrus orchards, irrigated by drip irrigation, thereby abandoning the traditional crops. However, most of these farms suffer from the reduction in the State presence and the water shortage. This concerns particularly the micro-farms, where farmers put up with the existing situation: no access to groundwater and limited options for improving the productivity due to a diversity of reasons (lack of capital and/or social network, knowledge, risk aversion…). These farms seem bound for poverty and often do not have a credible successor, as many youngsters have migrated to urban areas or abroad. These families are reluctant to sell the land, when they are able to obtain an annual rent, while downsizing the importance of agricultural revenues. This affects negatively the rural economy of the Tadla.

The second conclusion is that the access to groundwater has provided the opportunity to farms to opt for agricultural diversification. Today, most of the revenues generated in the Tadla irrigation scheme are produced on 70% of the area served jointly by surface water and groundwater, but concerning only 46% of the farmers. On these farms, farmers diversify cropping systems (fruit trees, horticulture) and increase the crop production and the livestock. Groundwater has thus absorbed some of the shock of the surface water droughts. However, groundwater shows so far limited redistributive capacity for most of the small farms, of which only about 20% have direct access to groundwater. In addition, only a minority of small-scale farmers obtains access to water through informal arrangements (Boudjellal et al, forthcoming), which can be considered as reciprocity mechanisms. This concerns mainly heirs sharing a family farm, investing jointly in a tubewell, or occasional access of neighbors or family members to tubewells in case of sustained droughts. If all farms would obtain an equitable access to groundwater, this would certainly allow small-scale farms to improve their agricultural revenues and livelihoods. However, this is certainly not sufficient as farmers may install themselves in a rent seeking position. A good balance will have to be sought in promoting market exchanges, redistribution and reciprocity mechanisms in order to keep Morocco's countryside not only productive, but also full of life.

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